A.D. 1868, *4th February.* N° 377.

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Refrigerating and Heating Apparatus.

LETTERS PATENT to Robert Morton, of 5, Cambridge Lodge Villas, Hackney, in the County of Middlesex, Engineer, for the Invention of "IMPROVEMENTS IN REFRIGERATORS OR APPARATUS FOR COOLING LIQUIDS, PARTS OF WHICH IMPROVEMENTS ARE ALSO APPLICABLE TO DISTILLATION, SURFACE CONDENSATION, AND HEATING AIR FOR BLAST FURNACES, OR OTHER PURPOSES."

Sealed the 7th July 1868, and dated the 4th February 1868.

PROVISIONAL SPECIFICATION left by the said Robert Morton at the Office of the Commissioners of Patents, with his Petition, on the 4th February 1868.

I, ROBERT MORTON, of 5, Cambridge Lodge Villas, Hackney, in the County of Middlesex, Engineer, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN REFRIGERATORS OR APPARATUS FOR COOLING LIQUIDS, PARTS OF WHICH IMPROVEMENTS ARE ALSO APPLICABLE TO DISTILLATION, SURFACE CONDENSATION, AND HEATING AIR FOR BLAST FURNACES, OR OTHER PURPOSES," to be as follows :—

This Invention relates to certain arrangements and improvements in refrigerators or apparatus for cooling liquids, worts, or other fluids

(for which Letters Patent have already been granted to me, No. 939, 1862), and consist in arranging one-half or any portion of the tubes which form the apparatus or cooler on a hinged frame attached to and forming part of the cooler; or instead of hinging a certain portion of the tubes I fix them to a separate frame so that they can be raised entirely clear or lifted bodily out from amongst the fixed tubes. I use separate streams of water or other suitable liquid for cooling the stream or streams in the hinged or lifting part of the apparatus, being separate from the stream or streams in the fixed part; or I cool the metallic tubular surface with mixtures of water and ice, or freezing mixtures, such as salts or acids, or salts and acids combined, or with any of these liquids aerated with attemperated air from "Walker's Patent Attemperator;" or I use a mixture of solid carbonic acid and ether, separately or in combination with water, or water mixed with certain proportions of chloride of lime or chloride of calcium; or I force currents of attemperated air through or over the tubular surface by means of a force pump, cylinder, or fan, or attemperated air and suitable liquids or freezing mixtures through alternate tubes, or attemperated air through the hinged or lifting portion of the cooler, and suitable liquids or freezing mixtures through the fixed portion, or vice versa.

A further improvement consists in the use of compressed air alone or in combination with water or other suitable liquids; the air is compressed by cylinder or pump of suitable construction, the temperature being raised by compression; it is then allowed to expand in a separate vessel or receiver, by which its temperature is considerably reduced. Supposing the atmospheric temperature to be 65° Fahrenheit, and the temperature be raised 40° by compression, and again cooled to 65° and permitted to expand, the temperature will be decreased to about 25°, not positively, but more or less. This cold air may be conveyed to a vessel or receiver and be used to lower the temperature of the following portion of compressed air, the temperature of which may be again reduced by expansion to a point below zero; by this means the temperature may be almost reduced to any degree.

Again in my former Patent, No. 939, 1862, the tubular surface was straight, I now propose to make it zig-zag or corrugated, and to fix the tubes at any angle of inclination. The hinged or lifting portion of the cooler I fix at the ends in grooves formed in the fixed portion, or

with suitable facings of india-rubber, or similar material to prevent the liquids flowing past between the ends of the tubes and sides of the cooler. I further propose to braze the tubes to the sides, or fix them by flanges with rivets or bolts.

The same improvements herein-before detailed are applicable to that part of my former Patent, No. 939, 1862, which relates to distillation and surface condensation.

I would further observe that I use the same arrangement of tubular surface for cooling worts as described for distillation and surface condensation in my former Patent.

Again, I propose in passing the worts through the tubes to force by means of pump, cylinder, or fan, currents of attemperated or cold air, separately or in combination with water or other suitable liquid into the case surrounding the tubular surface, or vice versa, worts outside of the tubes, and air or water, or air and water, or other suitable liquid inside of the tubes.

My improvements in that portion of my former Patent, No. 939, 1862, which relates to heating air for blast furnaces and other purposes consists in forming the tubular ways or channels of fire-brick or fire-clay instead of cast iron or other metal. I propose to mould the tubes of fire-clay with suitable caps for connecting the ends, or I propose to build the tubular ways or channels of fire-bricks, the air to be heated passing inside the tubular ways in one direction, and the flame or hot gases issuing from the furnaces or other sources passing alternately under and over the tubular ways in an opposite direction, as described in my former Patent.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Robert Morton in the Great Seal Patent Office on the 27th July 1868.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, ROBERT MORTON, of 5, Cambridge Lodge Villas, Hackney, in the County of Middlesex, Engineer, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fourth day of February, in the year

of our Lord One thousand eight hundred and sixty-eight, in the thirty-first year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Robert Morton, Her special licence that I, the said Robert Morton, my executors, administrators, and assigns, or such others as I, the said Robert Morton, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might, make use, exercise, and vend within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN REFRIGERATORS OR APPARATUS FOR COOLING LIQUIDS, PARTS OF WHICH IMPROVEMENTS ARE ALSO APPLICABLE TO DISTILLATION, SURFACE CONDENSATION, AND HEATING AIR FOR BLAST FURNACES, OR OTHER PURPOSES," upon the condition (amongst others) that I, the said Robert Morton, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Robert Morton, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement (that is to say) :—

This Invention relates to certain arrangements and improvements in refrigerators or apparatus for cooling liquids, worts, or other fluids (for which Letters Patent have already been granted to me, No. 939, 1862), and consist in arranging one-half or any portion of the tubes which form the apparatus or cooler on a hinged frame, attached to and forming part of the cooler, or instead of hinging a certain portion of the tubes I fix them to a separate frame, so that they can be raised entirely clear or lifted bodily out from amongst the fixed tubes. I use separate streams of water or other suitable liquid for cooling, the stream or streams in the hinged or lifting part of the apparatus being separate from the stream or streams in the fixed part, or I cool the metallic tubular surface with mixtures of water and ice or freezing mixtures, such as salts or acids, or salts and acids combined, or with any of these liquids aerated with attemperated air from "Walker's Patent Attemperator," or I use a

mixture of solid carbonic acid and ether separately or in combination with water, or water mixed with certain proportions of chloride of lime, or chloride of calcium; or I force currents of attemperated air through or over the tubular surface by means of a force pump, cylinder, or fan; or attemperated air and suitable liquids or freezing mixtures, through alternate tubes; or attemperated air through the hinged or lifting portion of the cooler, and suitable liquids or freezing mixtures through the fixed portion, or vice versa.

A further improvement consists in the use of compressed air alone or in combination with water or other suitable liquids. The air is compressed by cylinder or pump of suitable construction, the temperature being raised by compression, it is then allowed to expand in a separate vessel or receiver by which its temperature is considerably reduced. Supposing the atmospheric temperature to be 65° Fahrenheit, and the temperature be raised 40° by compression, and again cooled to 65° and permitted to expand, the temperature will be decreased to about 25°, not positively, but more or less. This cold air may be conveyed to a vessel or receiver and be used to lower the temperature of the following portion of compressed air, the temperature of which may be again reduced by expansion to a point below zero; by this means the temperature may be almost reduced to any degree.

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I would further observe that I use the same arrangement of tubular surface for cooling worts as described for distillation and surface condensation in my former Patent.

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air separately or in combination with water or other suitable liquid into the case surrounding the tubular surface, or vice versa, worts outside of the tubes, and air or water, or air and water, or other suitable liquid inside of the tubes or case.

My improvements in that portion of my former Patent, No. 939, 1862, which relates to heating air for blast furnaces and other purposes consists in forming the tubular ways or channels of fire-brick or fire-clay instead of cast iron or other metal. I propose to mould the tubes of fire clay with suitable caps for connecting the ends; or I propose to build the tubular ways or channels of fire-bricks, the air to be heated passing inside the tubular ways in one direction, and the flame or hot gases issuing from the furnaces or other sources passing alternately under and over the tubular ways in an opposite direction as described in my former Patent.

And in order that my said Invention may be thoroughly comprehended I shall proceed to describe the illustrative Figures upon the Sheets of Drawings which I have hereunto attached for the purpose of shewing certain modifications, under which my improvements may be carried into practice.

The Figures on Sheet A of the Drawings accompanying this Specification illustrate certain modifications of my improvements in refrigerators.

Fig. 1 is a longitudinal section, Fig. 2, a plan, and Fig. 3, transverse section. The same letters refer to corresponding parts in each view.

a, *a*, *a*, *a*, are the fixed tubes attached to the frame B; *b*, *b*, *b*, *b*, are the moveable tubes attached to the hinged or removeable frame C; *d*, *d*, *d*, *d*, are screw toggles for holding it firmly to the fixed frame; d^1, d^1, snugs for lifting by, to raise it from its seat for facility of cleansing. Each series of tubes is connected alternately at the ends by the caps *e*, *e*, and e^1, e^1, thereby forming a continuous channel for the cooling liquid which enters through the pipes *f*, f^1, and passes out through *g*, g^1. The worts are admitted into the trough *h* and flow in an opposite direction to the water or other cooling liquid, as indicated by the arrows, alternately under and over the tubes, and are discharged at h^1. The remaining worts in each compartment are discharged, as described in my former Patent, No. 939, 1862.

Fig. 4, Sheet A, is a longitudinal section of a modification of refrigerator in which the tubes are arranged angularly, in other respects it is the same as Figs. 1, 2, & 3; the same letters being descriptive of similar parts.

Figs. 5 & 6, Sheet A, shew a form of tube slightly curved or corrugated instead of straight, the object being to increase the surface and retard the too rapid flow of the cooling liquid.

Figs. 7, 8, & 9, Sheet A, shew an arrangement of fixed and removeable tubes on a larger scale. Fig. 7 shews the moveable tubes d, d^1, fitting into a plain groove formed by the angle pieces a, a, or into a recess b in the side of cooler C, as shewn by dotted lines.

Figs. 8 & 9, a, a, angle pieces forming the groove; c, lining of india-rubber; d, removeable tubes connected by caps d^1; e, e, fixed tubes connected by caps e^1, e^1.

Fig. 10, Sheet A, section of tubes with flanges for bolting or rivetting to sides of cooler.

Figures 1, 2, & 3, Sheet B, shew another modification of my improvements in refrigerators.

Fig. 1 is a side elevation, partly in section, Fig. 2 a transverse section, Fig. 3 a plan. The same letters refer to corresponding parts.

a, a, a, a, are a series of tubes connected alternately at the ends by the caps b, b, b, b, so as to form a continuous channel; c, upper trough, the bottom of which is perforated and covered with metallic cloth; d, d, wooden case lined with copper and hinged at d^1; e, e, e, e, tubular air ways perforated with small holes on the curved side; e^1, e^1, main air tubes connecting the air ways e, e, e, e, together; f, lower trough; f^1, outlet; g, loose pins for holding the sides of the case d, d, to the frame h, h. This arrangement is capable of different modes of application; the worts or liquid to be cooled may enter the tubes a, a, a, a, at b^1 and pass out at b^{11}, whilst the water or cooling mixtures may flow through the bottom of the trough c, upon the external surface of the tubes a, a, a, a, and finally into the lower trough f, at the same time currents of cold or attemperated air may be forced into the case by fan or cylinder through the tubes e^1, e^1, or the reverse, the worts may flow from the upper trough c on to the external surface

of the tubes *a*, *a*, *a*, *a*, and thence into the trough *f*, whilst cold attemperated air or water, or water and air in combination, or any suitable liquids are forced by pump through the interior of the tubes *a*, *a*, *a*, *a*, whilst at the same time currents of attemperated or cold air are forced into the interior of the case through the tubes e^1, e^1, and *e*, *e*, *e*, *e*, by fan or cylinder.

Figs. 4, 5, 6 & 7, Sheet B, are sections of different forms of tubes which I propose to use.

Figs. 8, 9, 10 & 11, Sheet B, shew certain modifications of my improvements in stoves for heating air for blast furnaces or other purposes.

Fig. 9, longitudinal section, Fig. 10, sectional plan, Fig. 11, transverse section. *a* and *b* are the furnaces from which the flame passes through the flues *c*, *c*, *c*, over and under the air ways *f*, *f*, *f*, in the direction of the arrows into the chimney *e*. The air is driven in at *g* and traverses the air ways in the direction of the arrows, passing out a g^1 (Fig. 11). The flue ways *c*, *c*, *c*, are open at top and covered by slabs *i*, *i*, *i*, which are fitted close by means of fire-clay; by this arrangement the soot or other deposit in the flues may be brushed down into the spaces or receptacles *j*, *j*, *j*, and cleared out through the inlets *k*, *k*, *k*, which are temporaryily closed, the inlet *l* is also for a similar purpose; *m*, *m*, *m*, fire-bricks supporting bottom of air ways; *n*, *n*, spaces for the passage of the flame, the tops of the air ways are arranged similar to the bottom; *o*, *o*, stoppings for stiffening sides of air ways; *p*, brick lining to protect the air way from the direct action of the flame; *q*, *q*, concrete filling.

Fig. 8, Sheet B, transverse section of air way with metallic lining f^1 which I sometimes use.

Having now described the nature of my said Invention, I may observe in conclusion that I claim as the Invention secured to me,—

Firstly. The general arrangement and construction of apparatus for cooling worts, liquids, or fluids, as herein described and illustrated by Figs. 1, 2, 3, 4, 5, 6, 7, 8, 9, & 10, Sheet A, of the Drawings attached.

Secondly. The general arrangement and construction of apparatus for cooling worts or fluids, distillation or condensation, as herein described and shewn in Figs. 1, 2, 3, 4, 5, 6 & 7, Sheet B, of the Drawings.

Thirdly. The general arrangement and construction of stove for heating air, as described herein and illustrated, Fig. 8, 9, 10 & 11, Sheet B, of the Drawings.

In witness whereof, I, the said Robert Morton, have hereunto set my hand and seal, this Twenty-third day of July One thousand eight hundred and sixty-eight.

ROBERT MORTON. (L.S.)

Witness,

EDWD. ROBINSON.

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1868.

A.D. 1868. FEB. 4. Nº 377.
MORTON'S SPECIFICATION.

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FIG. 1.

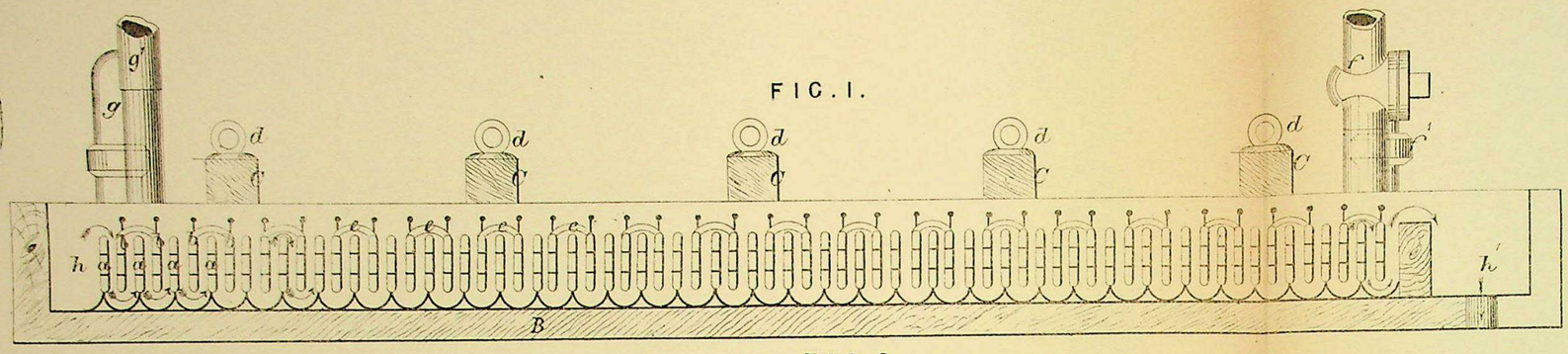

FIG. 3.

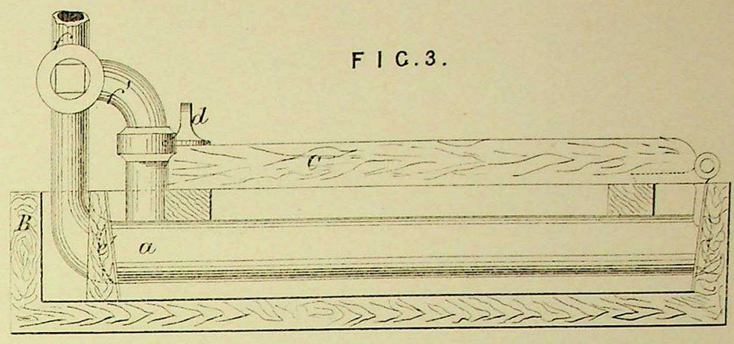

FIG. 2.

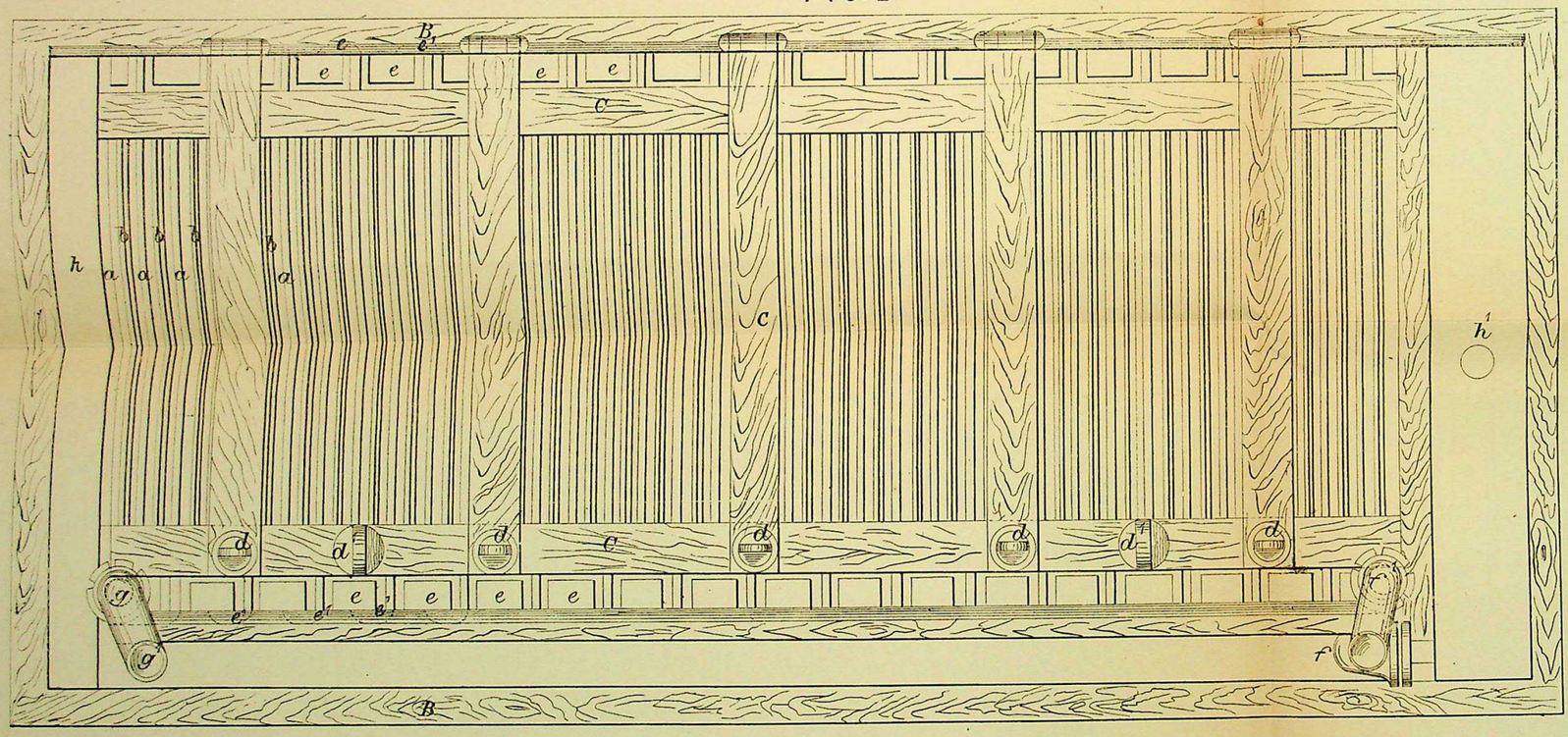

FIG. 7.

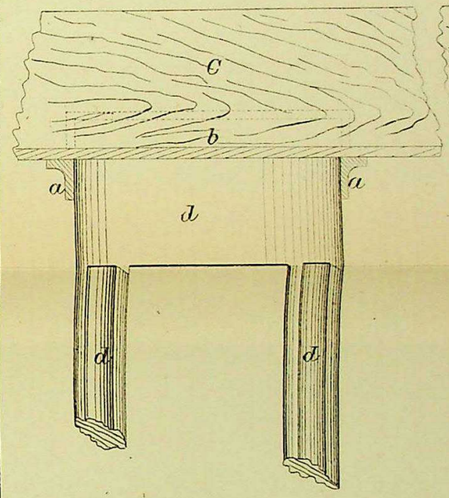

FIG. 8.

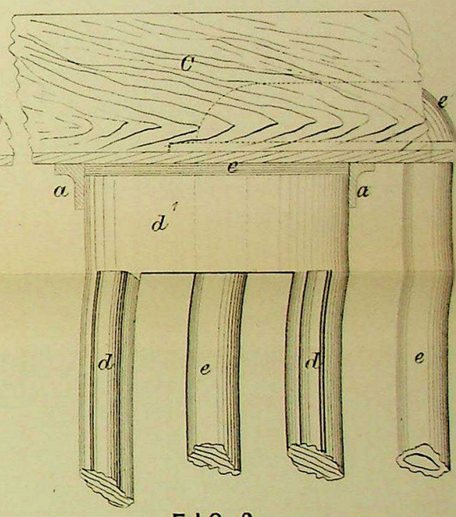

FIG. 10

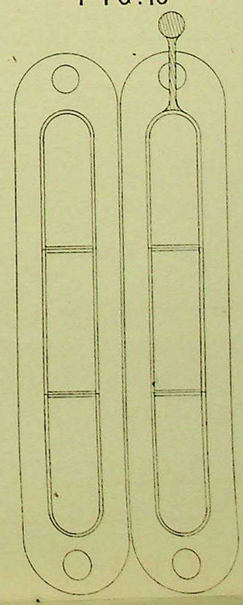

FIG. 9.

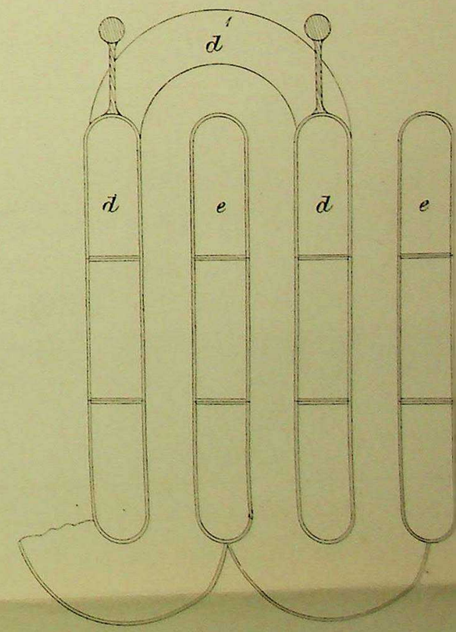

FIG. 4.

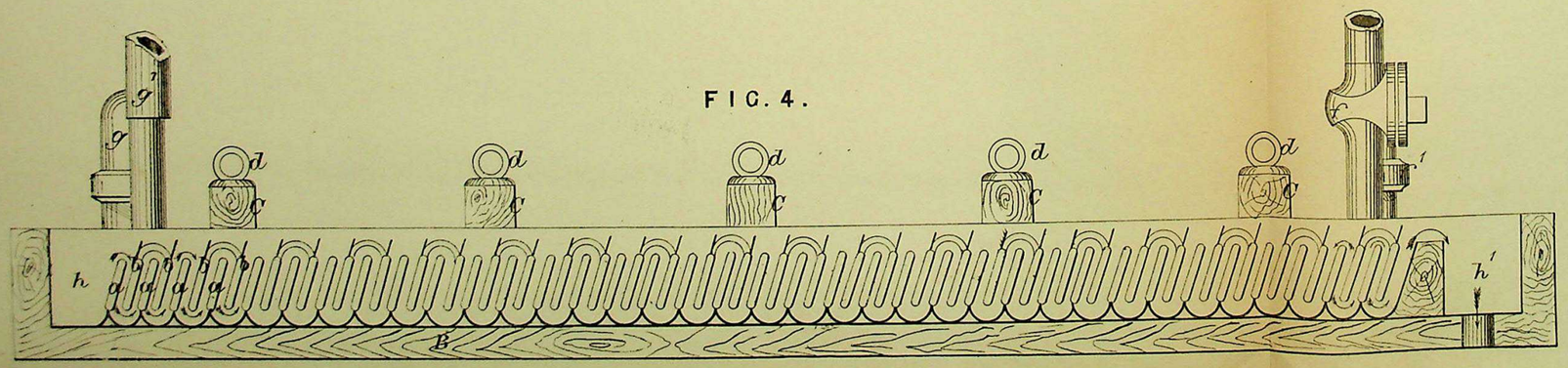

FIG. 5.

FIG. 6.

Figs. 1, 2, 3, & 4. Scale 1″=1 foot.
Figs. 7, 8, 9, & 10. " ½ size.

The filed drawing is partly colored.

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FIG. 1.

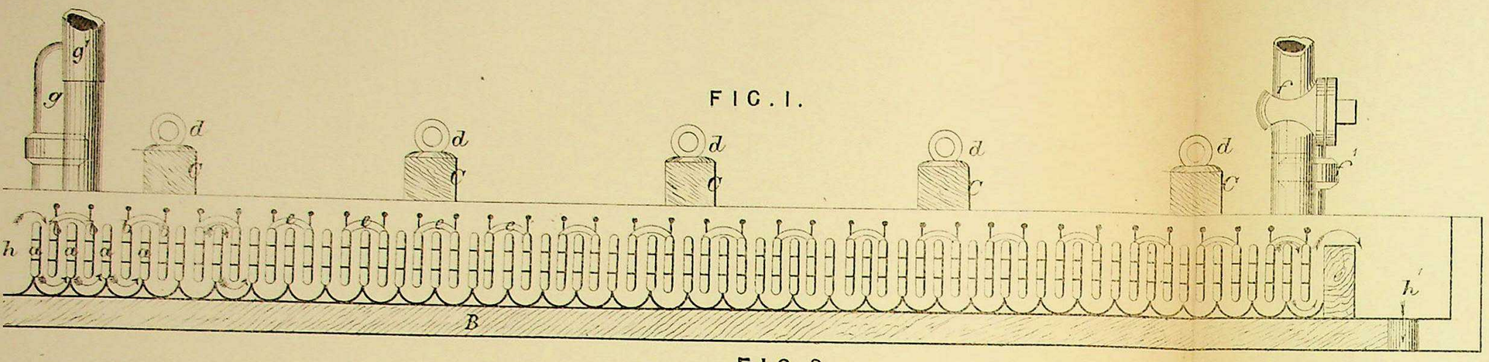


FIG. 2.

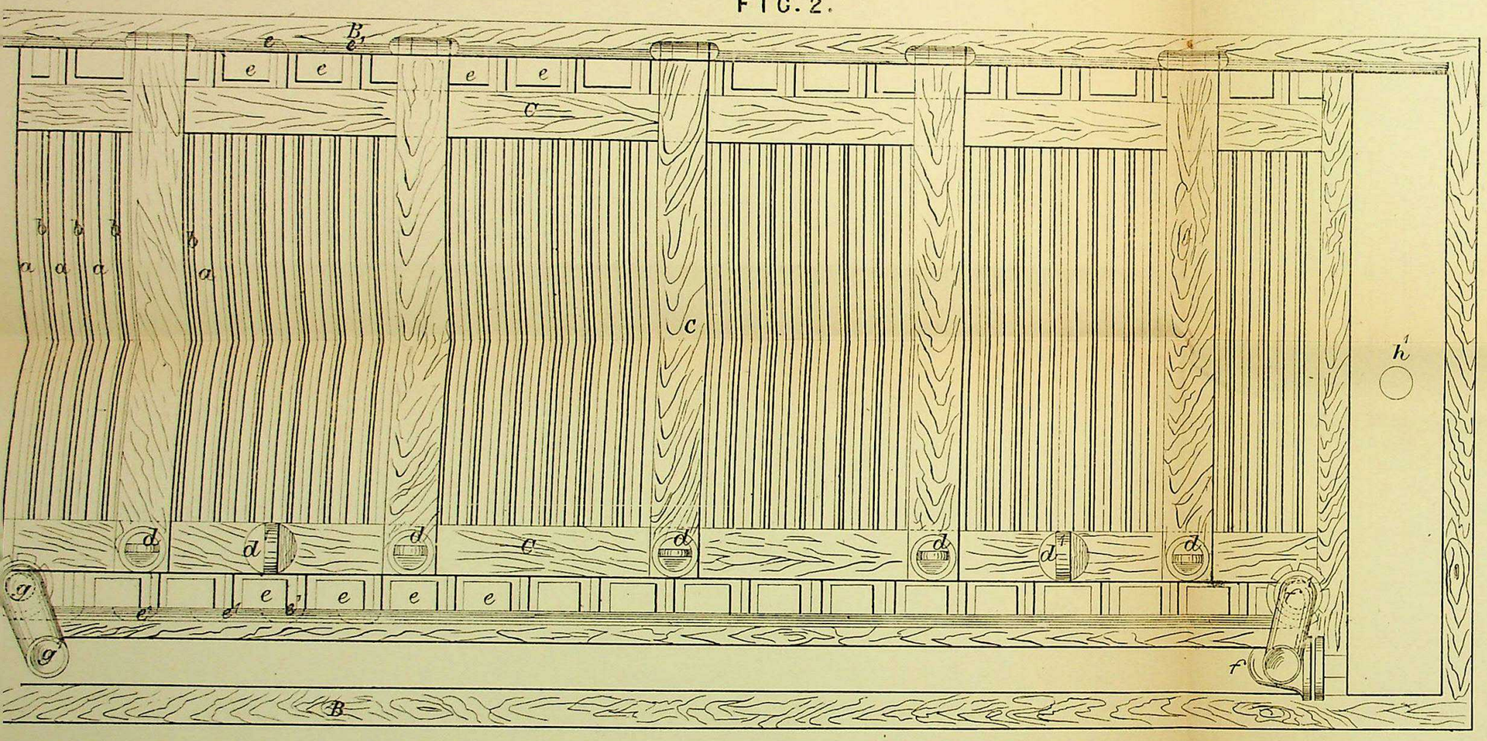


FIG. 3.

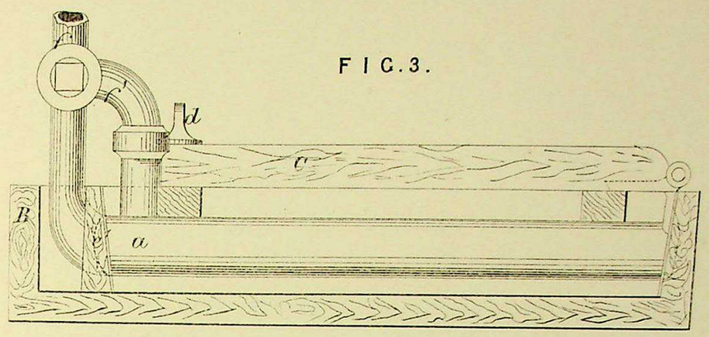


FIG. 4.

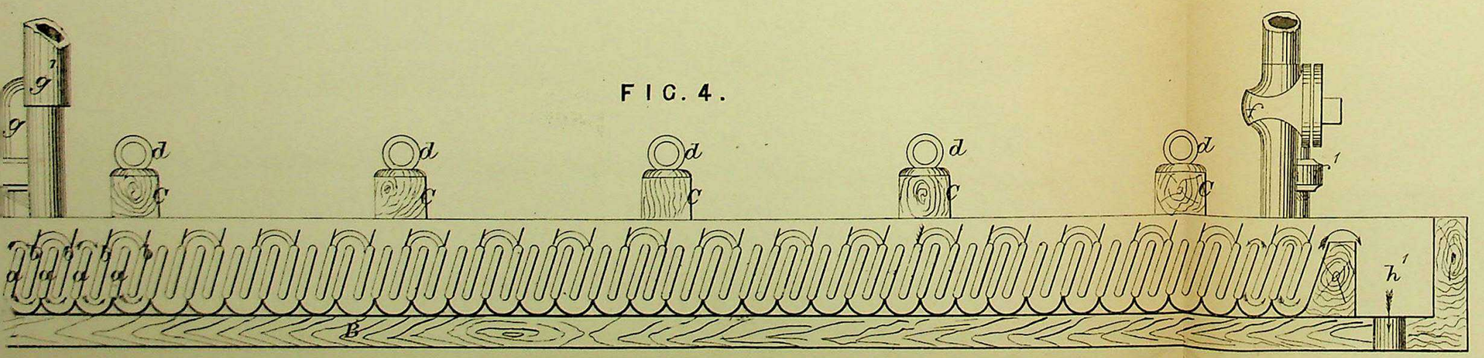


FIG. 5.

FIG. 6.

FIG. 7.

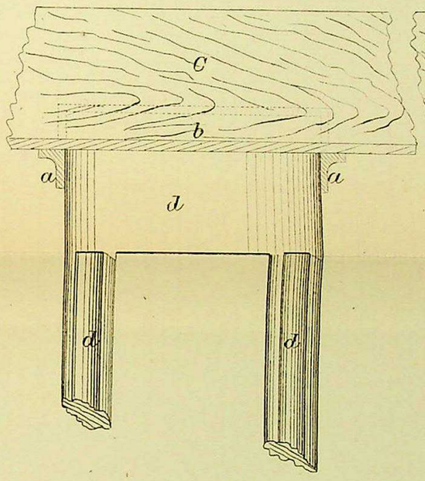


FIG. 8.

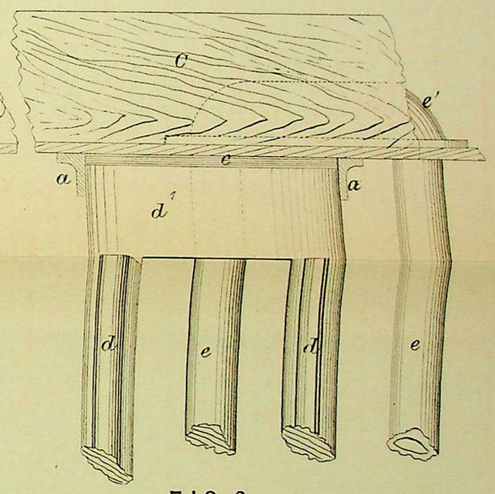


FIG. 10

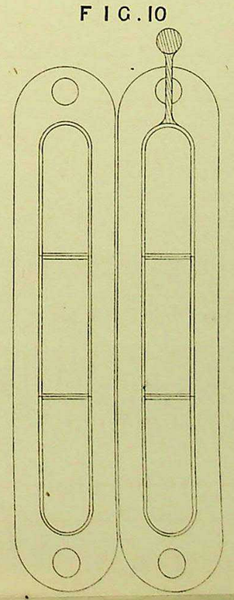
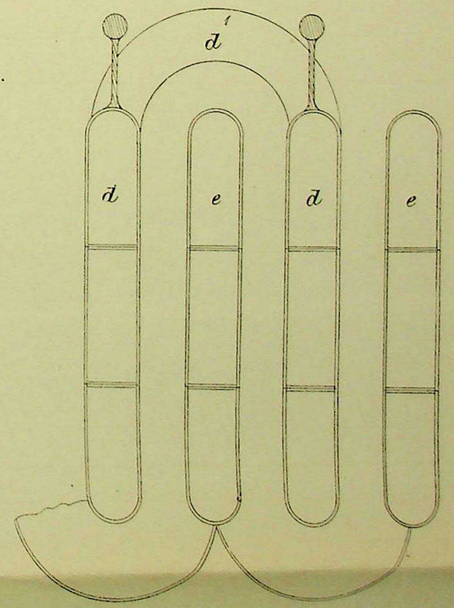


FIG. 9.



Figs. 1, 2, 3, & 4. Scale 1″=1 foot.
Figs. 7, 8, 9, & 10. „ ½ size.

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Drawn on Stone by Malby & Sons.

LONDON: Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty 1868.

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FIG. 9.

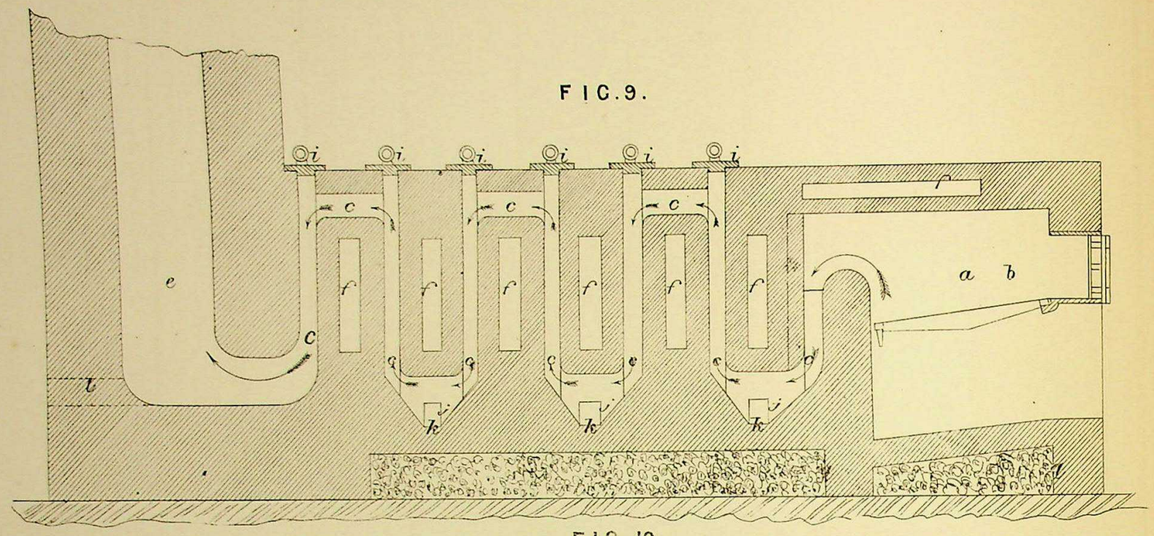


FIG. 10.

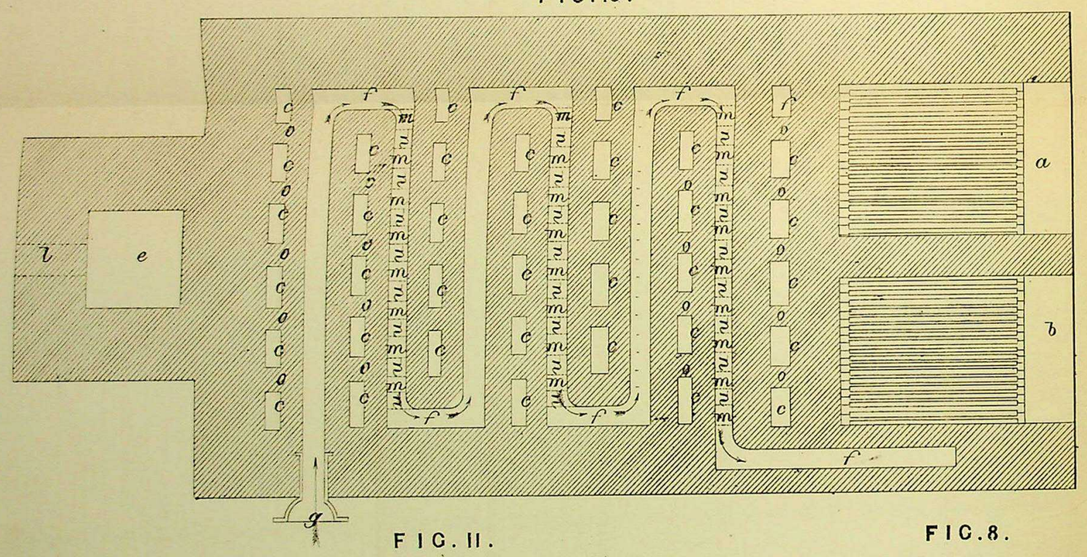
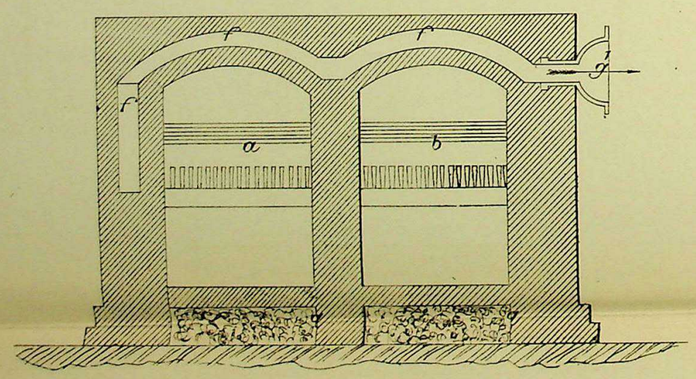


FIG. 11.



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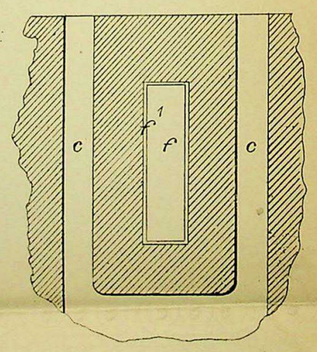

FIG. 1.

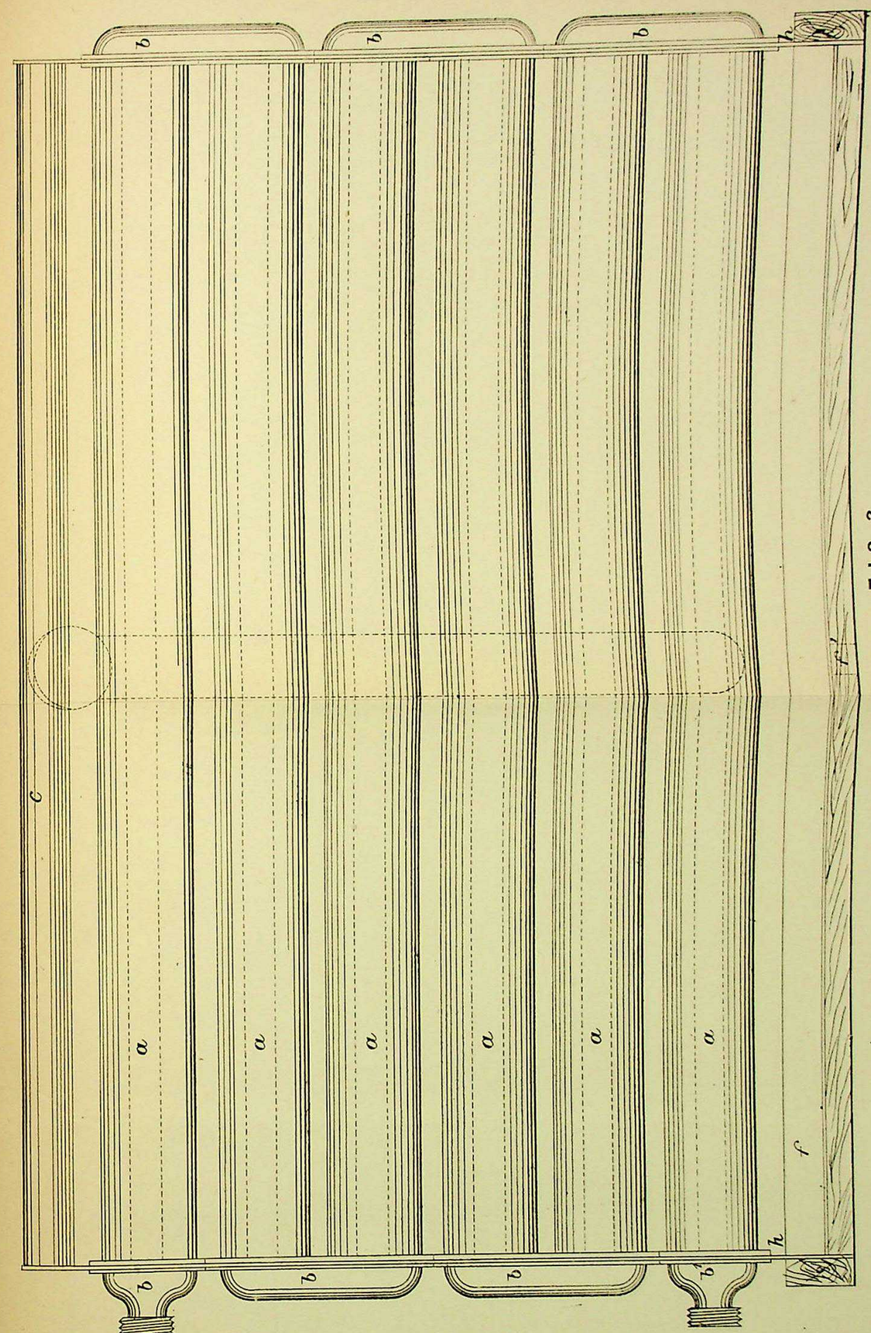

FIG. 3.

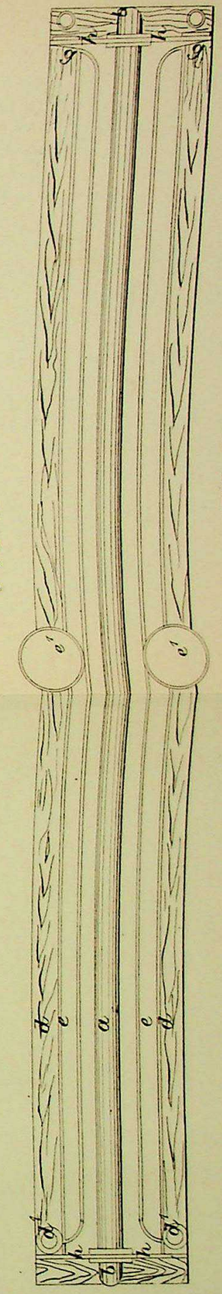

FIG. 4. FIG. 5. FIG. 6. FIG. 7.

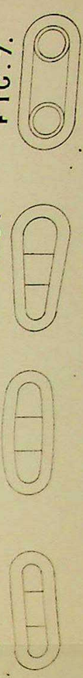

FIG. 2.

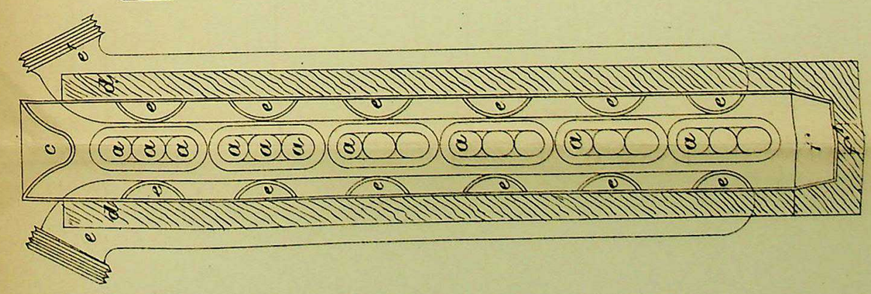

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FIG. 9.

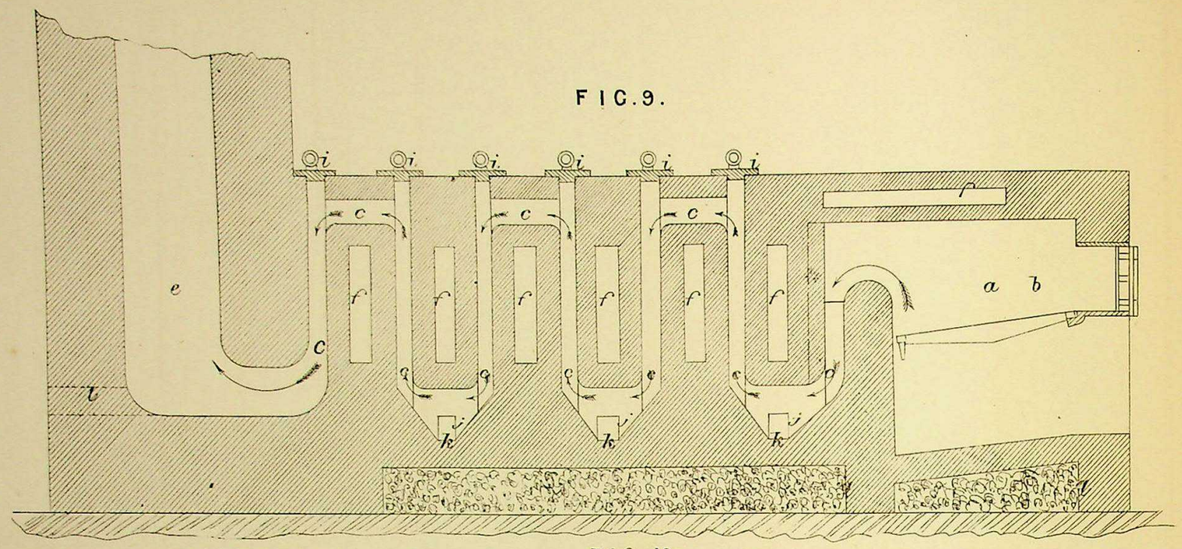


FIG. 10.

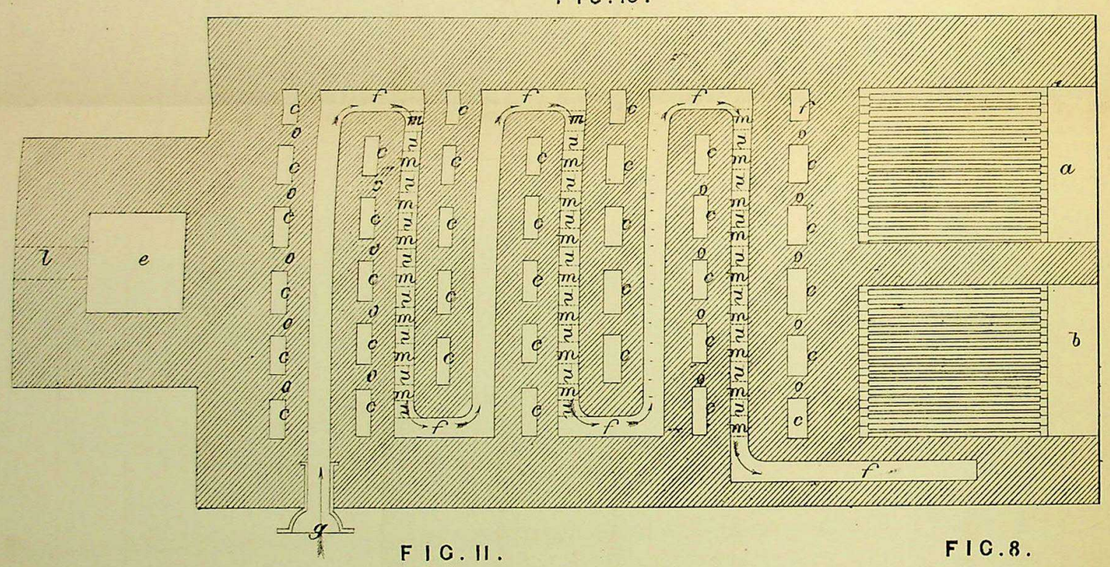
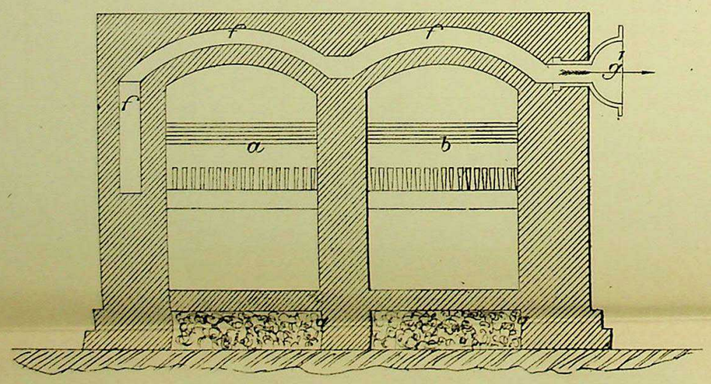


FIG. 11.



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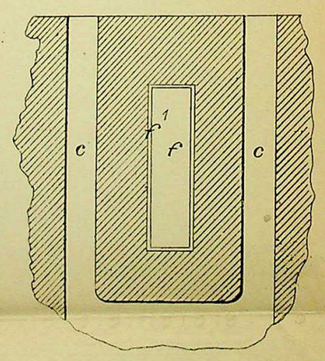

FIG. 1.

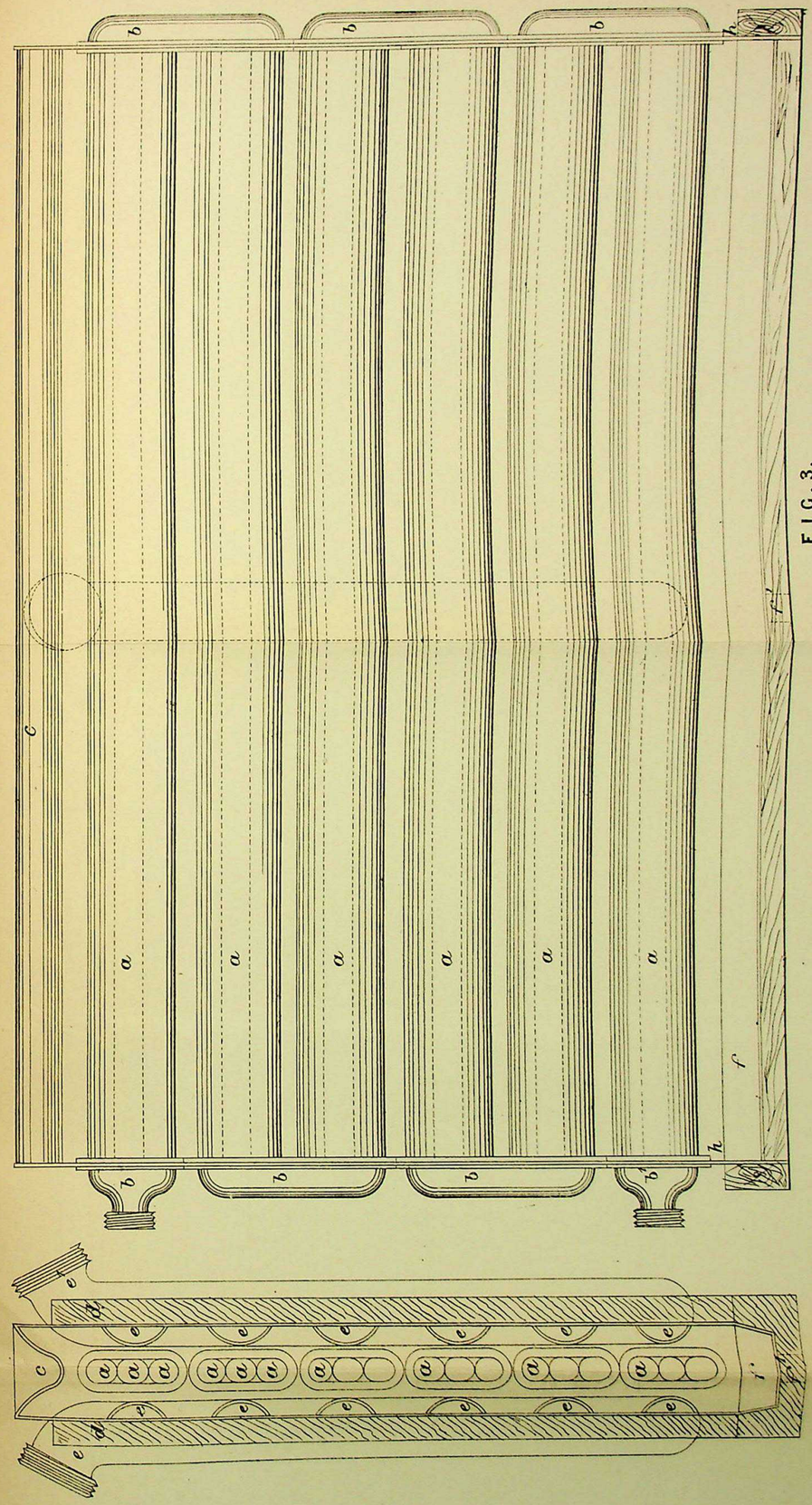

FIG. 3.

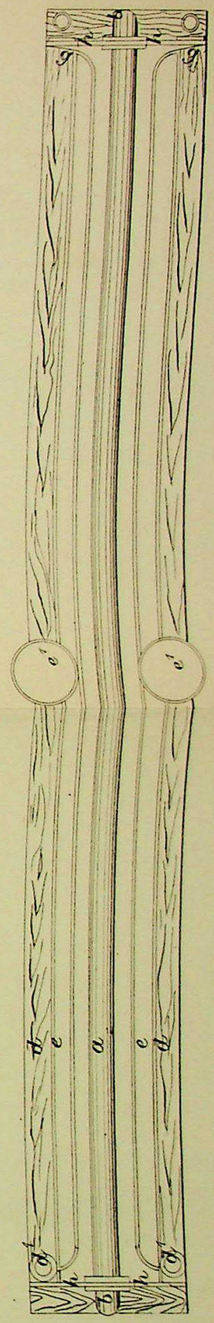

FIG. 4. FIG. 5. FIG. 6. FIG. 7.

FIG. 2.

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FIG. 9.

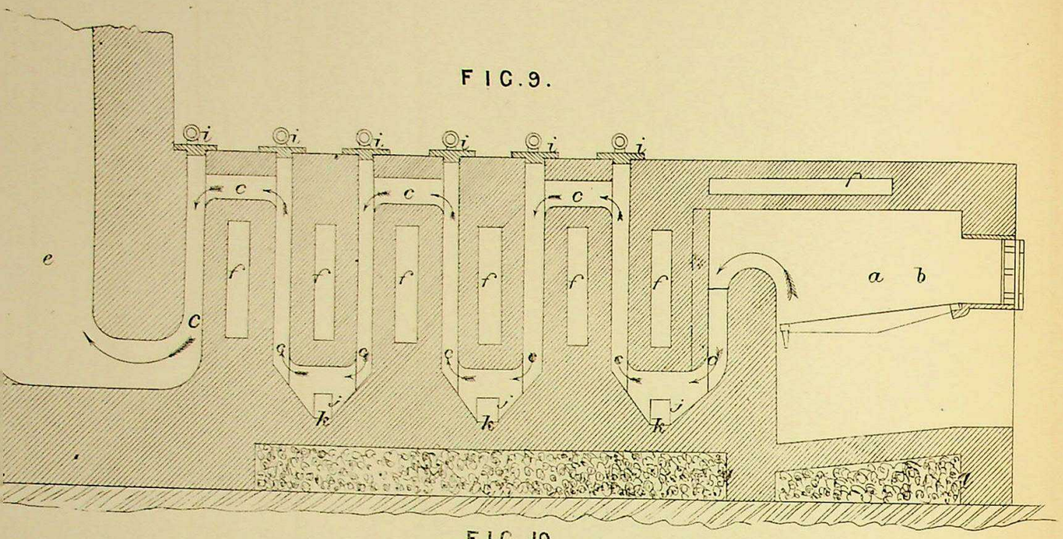


FIG. 10.

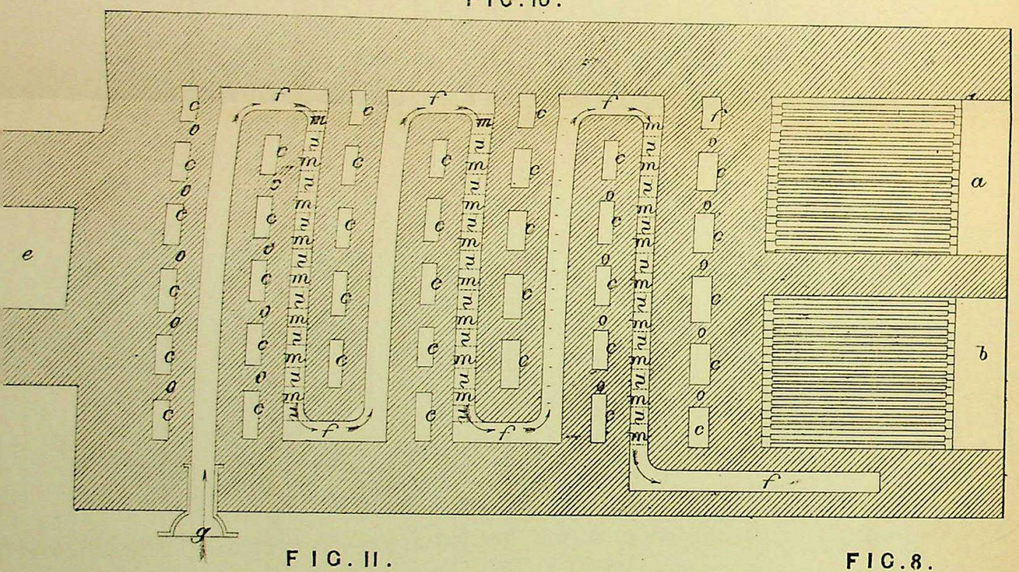


FIG. 11.

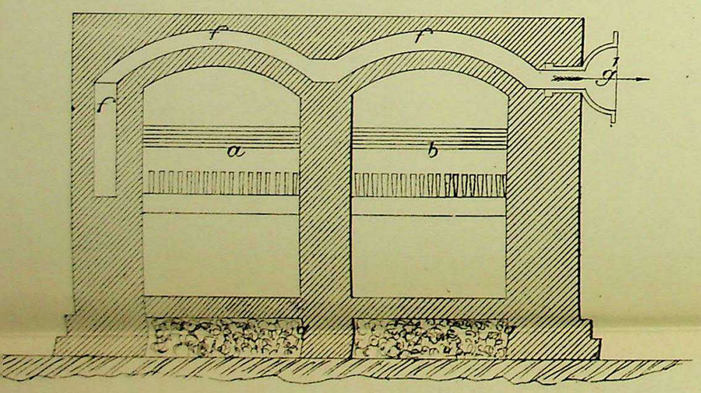


FIG. 8.

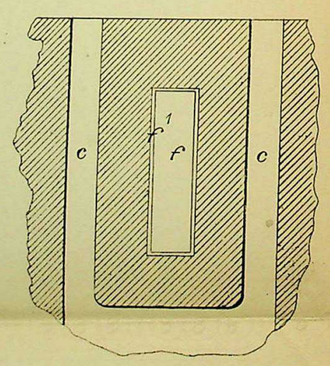


FIG. 1.

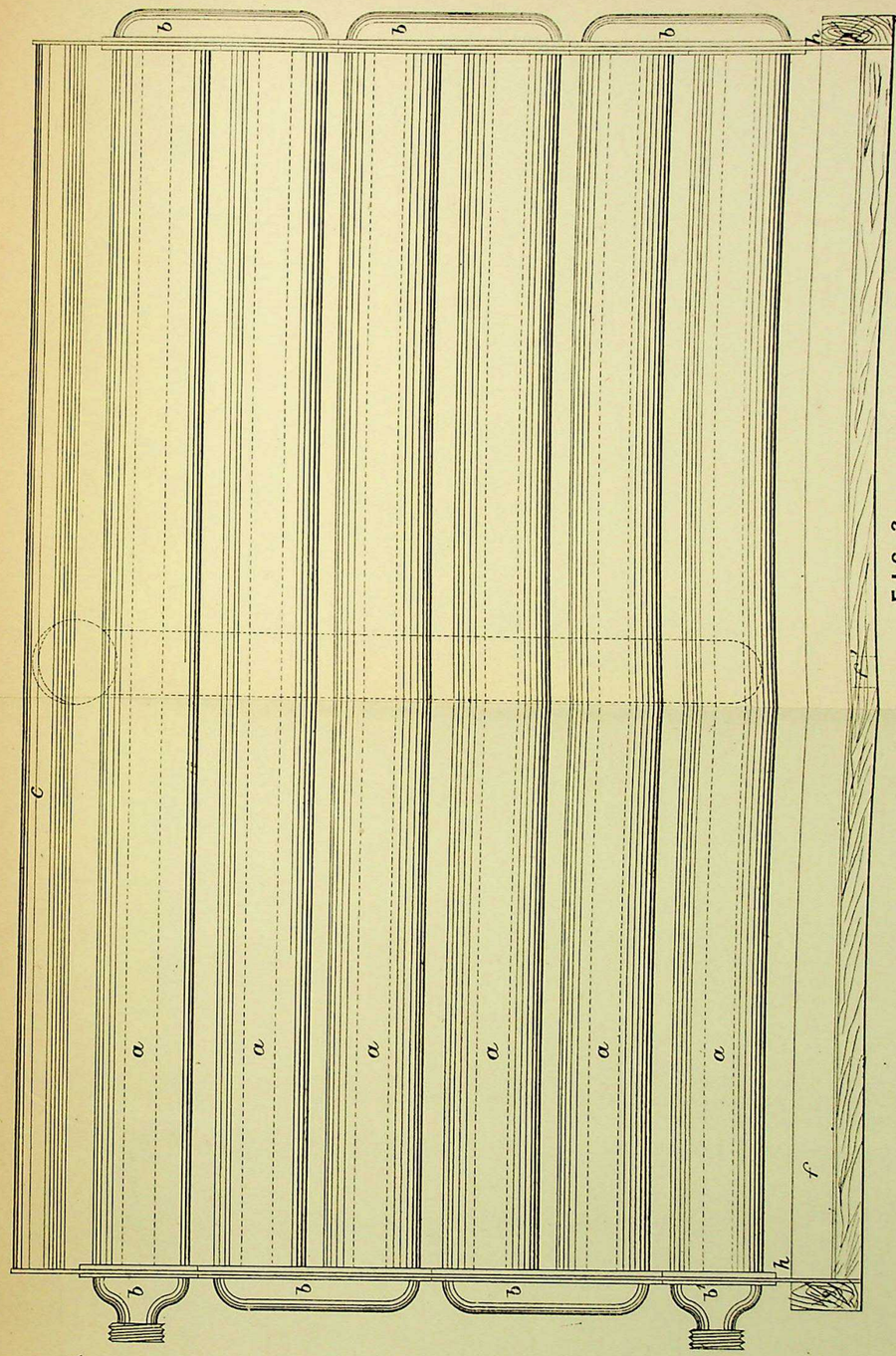


FIG. 3.

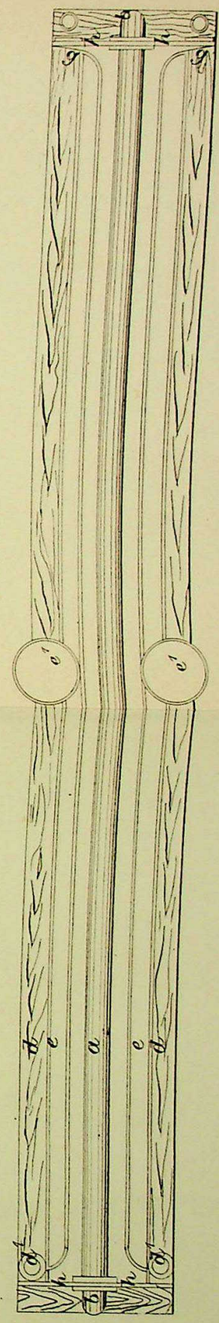


FIG. 4.

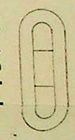


FIG. 5.

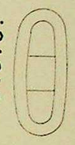


FIG. 6.

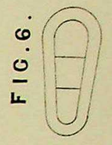


FIG. 7.

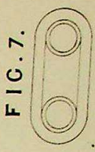
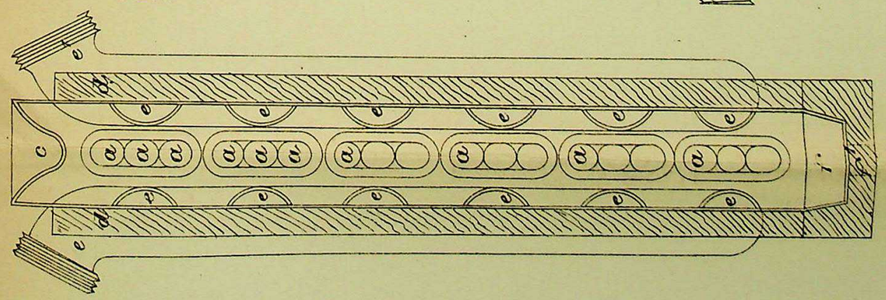


FIG. 2.



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